

## CLAIMS

What is claimed is

1 A protective sheath for an ultrasonic fragmenting device includes a handpiece to be held and manipulated by a surgeon, the handpiece with a housing, an ultrasonic motor mounted therewithin, an ultrasonic horn connected to the ultrasonic motor, an elongate ultrasonic probe attached to the ultrasonic horn, the elongate ultrasonic probe with an outer surface about and along its length and having vibratory nodes spaced along its length as a function of the resonant wavelength, and the protective sheath comprising:

a hollow sleeve having a proximal end and a distal end and surrounding the elongate ultrasonic probe and extending therealong,

an inner surface of the hollow sleeve formed, shaped, and sized to prevent contact with the outer surface of the elongate ultrasonic probe so that there is generally a clearance between the inner surface and the outer surface;

a connection on the proximal end of the hollow sleeve to connect the hollow sleeve to the housing, and

a termination on the distal end of the hollow sleeve at or near the most distal vibratory node of the elongate ultrasonic probe, the termination with a reduced inside diameter that is generally and substantially the same as the outside diameter of the elongate ultrasonic probe thereabout, forming generally a barrier to the passage of material into the clearance.

2 The protective sheath of claim 1 wherein the hollow sleeve is generally metallic.

3 The protective sheath of claim 1 wherein the hollow sleeve is generally polymeric.

4 A protective sheath for an ultrasonic fragmenting device includes a handpiece to be held and manipulated by a surgeon, the handpiece with a housing, an ultrasonic motor mounted therewithin, an ultrasonic horn connected to the ultrasonic motor, an elongate ultrasonic probe attached to the ultrasonic horn, the elongate ultrasonic probe with an outer surface about and along its length and having vibratory nodes spaced along its length as a function of the resonant wavelength, and the protective sheath comprising:

a hollow sleeve having a proximal end and a distal end and surrounding the elongate ultrasonic probe and extending therealong,

an inner surface of the hollow sleeve formed, shaped, and sized to prevent contact with the outer surface of the elongate ultrasonic probe along its length so that there is generally a clearance between the inner surface and the outer surface;

a connection on the proximal end of the hollow sleeve to connect the hollow sleeve to the housing, and

a flange of the elongate ultrasonic probe that circumscribes the elongate ultrasonic probe at or near the most distal vibratory node of the elongate ultrasonic probe, the flange with an outside diameter that is generally and substantially the same as the inside diameter of the hollow sleeve thereabout, forming generally a barrier to the passage of material into the clearance.

5 The protective sheath of claim 4 wherein the hollow sleeve is generally metallic.

6. The protective sheath of claim 4 wherein the hollow sleeve is generally polymeric.

7 A protective sheath for an ultrasonic fragmenting device includes a handpiece to be held and manipulated by a surgeon, the handpiece with a housing, an ultrasonic motor mounted therewithin, an ultrasonic horn connected to the ultrasonic motor, an elongate ultrasonic probe attached to the ultrasonic horn, the elongate ultrasonic probe with an outer surface about and along its length and having vibratory nodes spaced along its length as a function of the resonant wavelength, and the protective sheath comprising

a hollow sleeve having a proximal end and a distal end and surrounding the elongate ultrasonic probe and extending therealong,

an inner surface of the hollow sleeve formed, shaped, and sized to prevent contact with the outer surface of the elongate ultrasonic probe so that there is generally a clearance between the inner surface and the outer surface;

a connection on the proximal end of the hollow sleeve to connect the hollow sleeve to the housing, and

a termination on the distal end of the hollow sleeve, the termination with a clearance sufficiently small so as to effectively form a barrier to the passage of material therewithin

8 The protective sheath of claim 7 wherein the hollow sleeve is generally metallic

9 The protective sheath of claim 7 wherein the hollow sleeve is generally polymeric

10 The protective sheath of claim 7 wherein the termination is located at or near the most distal vibratory node of the elongate ultrasonic probe

11. A method of fragmenting or emulsifying a medium with axially applied ultrasonic vibrations, the method including the steps of

surrounding an elongate ultrasonic probe with a hollow sleeve, the hollow sleeve having an inner surface formed, shaped, and sized to prevent contact with the outer surface of the elongate ultrasonic probe along its length so that there is generally a clearance between the inner surface and the outer surface,

terminating the hollow sleeve at or near the most distal vibratory node of the elongate ultrasonic probe, the termination such that the inside diameter of the hollow sleeve is generally and substantially the same as the outside diameter of the elongate ultrasonic probe thereabout for forming generally a barrier to the passage of material into the clearance;

vibrating an elongate ultrasonic probe along its length;

engaging the medium with a distal end of the elongate ultrasonic probe, and

fragmenting and/or emulsifying the medium with the distal end of the elongate ultrasonic probe